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Bulletin - August, 1997

Civil Aviation Medical Association

BULLETIN

of the CIVIL AVIATION MEDICAL ASSOCIATION

AUGUST 1997

NEW ORLEANS & LOUISIANA
HERE WE COME!

A LITTLE INSIGHT INTO WHAT IS IN STORE FOR YOU AT THE CAMA SCIENTIFIC MEETING IN NEW ORLEANS: The Civil Aviation Medical Association's Annual Scientific Meeting's theme will be cardiology and it promises to be one of the best and most informative meetings ever.

• Phil Boyer, President of Aircraft Owners and Pilots Association will speak at the opening session. His subject will be "General Aviation 2000 and Beyond."

• Robert S. Poole, M.D., Manager, Medical Specialties Division, Office of Aviation Medicine, FAA will present up-to-date medical policy changes.

• Stephen Carpenter, M.D., Aeromedical Certification Division, Civil Aeromedical Institute, Oklahoma City will identify and attempt to clarify recent regulatory and policy changes concerning the criteria used to certify pilots.

• Ron Hansrote, M.D., Civil Aeromedical Institute, Oklahoma City will present some of the significant findings/changes in aircraft accident investigation that have occurred since CAMA's last scientific meeting.

Scheduled luncheon speakers are Col. (Ret.) Lawrence A. Zellers, Chaplain, USAF and former POW and CAMA's 1993-1995 President, Forrest M. Bird, M.D., Ph.D..

Present plans call for John Holliman, CNN National Correspondent, to speak after dinner on Honors Night.

This meeting promises to be captivating, informative, and economical; something that is difficult to find and all the more difficult, is to find such CME opportunity (AMA 19 Category 1 hours and AAFP 20 Prescribed Hours) in a world class city as New Orleans. Don't miss this outstanding program!

CONTINUING MEDICAL EDUCATION

The Civil Aviation Medical Association Scientific Meeting to be held in New Orleans, Louisiana on September 4-6, 1997 has been approved for the following credits:

American Academy of Family Physicians
20 Prescribed hours

American Medical Association
19 hours in Category 1

BULLETIN *of the Civil Aviation Medical Association (CAMA)*

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The BULLETIN of the Civil Aviation Medical Association (CAMA) is published bi-monthly for CAMA members and others interested in aviation medicine.

The CAMA motto is: "Pro Bono Publico," "For the good of the public."

CAMA's organizational purpose is: "To provide the civil aviation physicians with education, representation to government and a voice with industry and the public."

The BULLETIN editor welcomes submissions of articles/photos for publication. Please mail text in typewritten form or in WordPerfect software on floppy computer disk to:

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IN MEMORIAM

Dale G. Johnson, M.D., Midwest City, Oklahoma

Dr. Johnson was fatally wounded in his office on June 24, 1997. Dale was a very busy physician. He was a member of the Board of Trustees of the Civil Aviation Medical Association, a pilot, an AME, a Major in the Oklahoma Wing of the Civil Air Patrol, and an active amateur radio operator. Dale was a caring physician and will be missed by his patients. He will be remembered for his ready smile. He is survived by his wife and daughter, both of whom attended the 1996 annual CAMA meeting. The Medical Examiner has ruled his death a homicide, however the investigation is on-going. Memorial services were held in his native Canada and also in Edmond, Oklahoma.

CIVIL AVIATION MEDICAL ASSOCIATION
Corporate and Sustaining Members

The financial resources of individual members alone cannot sustain the Association's pursuit of its broad goals and objectives. Its forty-five year history is documented by innumerable contributions toward aviation health and safety that has become daily expectations by the world's flying population. Support from private and industrial sources is essential for CAMA to provide one of its important functions, that of education. The following support CAMA through Corporate and Sustaining Memberships:

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PRESIDENT'S MESSAGE ✈ ✈ ✈ ✈ ✈ ✈

It seems like I just finished writing my first President's page for the Bulletin, and the editor is letting me know that the August message is overdue. The year is flying by (again), and time passes much faster than I seem to move these days. The list of things to do still has more unfinished items than completed ones. On the other hand, we have moved along reasonably well so far this year. Our goal of increasing the frequency of publishing the Bulletin is becoming reality. We are obtaining articles from a variety of contributors, and the responsibility for publishing and editing the Bulletin has been more clearly defined than in the past. The job is no longer on only one member's shoulders, but is still well structured with an editorial board concept that should serve CAMA's needs as we grow and expand.

For our annual meeting this September, Jim Harris and the program committee have developed a very exciting scientific program. The educational material is blended with breaks, giving the attendees the opportunity to sample the flavor and color of the unique character of New Orleans. I have always enjoyed each trip I have made to this charming city, and I am looking forward to this trip as the best yet. As always, Jim has planned activities of interest for family members of the attendees so no one will be at a loss for something entertaining and educational to do during our stay in the Crescent City. If you have been undecided about attending this year's CAMA meeting, consider all that you might miss if you aren't there, and then firm up your plans to join us for a great time in September, down on the Mississippi. This is the last issue of the Bulletin that will be published before the meeting, so send your reservations and registration forms in now, before time slips past you, too.

One of the most gratifying things about being the President of CAMA is the continuing contact that I have with other members. We all get tied up with our practices and personal lives, and only have occasion to think about CAMA when the Bulletin comes or when we see each other at an AsMA or a CAMA meeting. The Board of Trustees and the elected officers have need to get together more often to address issues and develop policies and plans. That is time consuming, but it turns out to be a fringe benefit of the job. The more time one spends working with other members of our organization, the more obvious it becomes that this is a great group of truly caring and hard working aviation medical examiners. I have had great support from the membership this year, just as all of your presidents have received in the past. This is as good an occasion as any, to say thanks to you all as is likely to come along. It is a real pleasure to be part of this group, so come join in the fellowship and the fun this fall. We'll miss you if you aren't there.

See you in New Orleans.

A. Duane Catterson, M.D.

A. D. Catterson, M.D.,M.S.
President

EDITORIAL
IN-FLIGHT DEFIBRILLATION
PROS, CONS, AND PUBLIC OPINION

Studies have long since shown that prompt defibrillation of ventricular fibrillation (V fib) and pulse-less ventricular tachycardia results in a small but significant reduction in mortality. With the advent of the automated external defibrillator (AED's) incorporating failsafe designs that will not discharge in the presence of any rhythm other than Vfib or Vtac, non-medical personnel can be safely and quickly taught to use these devices appropriately. The rationale for teaching lay-people in the first place is the negative correlation between survival and the time lapse from onset of fibrillation to the application of the defibrillating shock. The principle of early defib has become universally accepted. AED's are durable, portable, lightweight and relatively inexpensive. This then, is the backdrop for the feasibility of putting these devices aboard aircraft of the U.S. commercial fleet.

At first glance, this seems like an easy decision. We have an automated, failsafe device that will "do no harm!" and with even a minimum of proper training, response time in an aircraft should be, on average, shorter than even the best EMT ground units. This is due to the likelihood that the precipitating event would be observed and that the personnel and the defibrillator would be in close proximity. This would imply that the airlines might be able to do even better than expected since response time has been shown to be the single most important predictor of (initial) success. Another intriguing aspect of these devices is the display of a modified EKG lead II. This might be of less value to a flight attendant with no medical background but to a "Good Samaritan" physician it could very well be reassuring enough to avoid a diversion of the aircraft. The cost of one such diversion to an intermediate airport will pay for many defibrillators. Proponents of this idea also point out that at a cost of "pennies per ticket" "the peace of mind" value alone may well be worth the money and effort. There are isolated, but nevertheless moving stories about flight attendants and volunteer physicians standing by, helpless and frustrated as a passenger expires. So, peace of mind for flight attendants and physicians to know that they had done everything possible must also be put into the equation. Of course, piece of mind of the passenger is what is usually meant and is of primary importance.

There are reasonable people that disagree with the concept of putting defibrillators on board aircraft. Studies have shown that even under the best of circumstances, survival to the point of ever leaving the hospital is on the order of 10% and in most studies between 2% and 7%. When we look at in-flight emergencies, we see that about 15% of these are cardiac in nature. What is hard to come by is denominator data. We know that domestically, about 600 million passengers are carried by the airlines. Of course, some of these are flights of a few minutes and others are several hours. By this, it is clear that the total number of passengers gives us incomplete data. After all, your chances of an in-flight emergency are greater the longer you are aboard the aircraft. Most studies use passenger miles to correct for this. This is also incorrect and leads to faulty data. Since the relative cruise speed of different types of aircraft (and even the same type of aircraft under different conditions) can easily vary 20% to 30% or more, what we should be looking for is passenger hours. One hundred passenger hours would be one passenger flying 100 hours or one hundred passengers flying 1 hour.

✈ ✈ ✈ *(continued on page 6)*

CORNEAL AND REFRACTIVE SURGERY AND THE PILOT
by John H. Rummel, M.D.

The Federal Aviation Administration (FAA) is granting waivers for the post-operative refractive surgery applicant, (Class I, II, and III).

Airmen, at the time of each examination are aware that good vision is a must. While this may be not so troublesome to a Class III, it can be a significant hurdle to those with more severe visual corrections needing a Class I or Class II. Changes in visual standards became effective in September 1996 that state:

- A distance visual acuity of 20/20 for each eye with or without correction for Class I or Class II. (Abolishes the minimum uncorrected visual acuity).
- Class III must read 20/40 with or without correction in each eye.
- A near vision of 20/40 with or without correction for Class I, II or III.
- If over the age of 50, an intermediate distance vision of 20/40. (Class I and II). (Measured at 32 inches).

With vision requirements a central part of an applicant's medical certificate, and even a factor for employment consideration, many persons today are opting for an uncorrected visual acuity of 20/20. Visual correction can be accomplished without surgical intervention, i.e., glasses and contact lenses. In recent times, medical examiners need to be aware of the newer modalities used to correct acuity.

The most common refractive error corrected by surgical means is nearsightedness (myopia). Myopia is an image focused in front of the retina. This occurs when the focusing power of the eye is too strong or commonly, the length of the eye being too long (axial myopia). The goal of refractive surgical technique is to decrease the refractive power of the cornea. Thus, the focal point of "vision" is moved back onto the retina.

✈ ✈ ✈ *(continued on page 8)*

CAMA LUNCHEON AT AEROSPACE WELL ATTENDED

Pictured left to right; A. Duane Catterson, M.D. Jon L. Jordan, M.D., J.D. and John D. Hastings, M.D.

A. Duane Catterson, M.D., President, of the Civil Aviation Medical Association, welcomed the over one hundred who attended the annual CAMA luncheon held in conjunction with the Aerospace Medical Association on May 12, in Chicago. Jon L. Jordan, M.D., J.D., Federal Air Surgeon, discussed the new medical standards and policy changes being implemented by his office. CAMA members wish to express their sincere thanks to Dr. Jordan for taking time from his busy schedule to be the luncheon speaker and to answer their questions.

Sustaining Member plaques were presented to John D. Hastings, M.D., and Gary Crump by Dr. Catterson.

Pictured left to right;
A. Duane Catterson, M.D., Gary Crump

Estimates of in-flight deaths on U.S. carriers based on individual domestic carrier statistics (notably United Airlines) and international carrier statistics (such as Virgin Atlantic, Air Canada and Qantas) would put the annual number somewhere between 100 and 300 deaths per year. If even 20% of these in-flight deaths had met the criteria for defibrillation and if 10% of those individuals could have been saved this would result in 2 to 6 lives saved per year. How much is life worth? If you ask this question to society in general you will hear things like, "Whatever it costs", "You can't put value on human life." The critic answers, "We have limited resources. It will cost roughly 10 million dollars per life saved with defibrillators. We can save hundreds and hundreds of lives if we apply the same amount of resources to immunization programs for children or drug, alcohol, and smoking education, or even preventive medicine programs for the early detection of chronic disease." So, while the critics of these on-board AED's don't deny that statistically a small number of lives will be saved, they hotly debate the denominator data, and they point to way fewer annual in-flight deaths. Critics also point out that the already meager survival rate of VF/VT is not only influenced by the rapidity of the response and restoration of a hemodynamically acceptable rhythm but also by how quickly the patient can be stabilized in an intensive care setting. The time interval to definitive care for the underlying problem is likely to be prolonged aboard an aircraft. They also point out that this time interval could be several hours on international flights where the first AED's are being installed. The chances of survival and hence more rational use of defibrillators would be aboard domestic flights where most people could be on the ground and in the care of a fully stocked life support unit within 20 minutes or so.

The definitive issue is but a part of a much larger issue. The debate is underway about what sort of medical supplies in general, should be available to the volunteer physician during an in-flight emergency. Critics use the defibrillation issue specifically, and the issue of more medical supplies in general, to support their view that this will intimidate physicians and make them less likely to volunteer. One colleague I spoke to said, "I always volunteer but if they start putting all that fancy equipment and high-powered IV drugs in the kits, I have a real concern that I am not going to know what to do in some situations." He is an ophthalmologist. Estimates vary but apparently only 40% to 50% of the on board physicians volunteer routinely. Of three doctors who admitted they did not "get involved" with in-flight emergencies, all three gave exposure to liability as their primary reason in spite of their knowledge of the Good Samaritan laws. One doctor gave a secondary reason and that was his lack of expertise in the area of emergency situations. The public is being told that the use of a defibrillator is the "right thing to do." Anecdotal stories abound about the tragic in-flight deaths that could have been avoided if only a defibrillator had been on board. The public is aware, or soon will be, that this perceived measure of security is available at a cost of only pennies per ticket. There is no doubt that the public will opt, as it always has, for that perfect world just beyond its grasp. Soon defibrillators will be the standard of care on all major airlines.

CAMA should encourage ongoing dialogue in the area of in-flight medical kits. We should encourage the airlines to keep detailed accounts of in-flight emergencies, how they are handled and their outcomes. Perhaps, we have a role in the education of passenger physicians in the proper handling of common in-flight medical emergencies. Cost effectiveness should always be a factor in any medical resource decision-making, but it should not be the only factor. If you view the use of on-board AED's as a misguided use of medical resources, be encouraged that the error lies on the humanitarian side of the equation.

WELCOME NEW CAMA MEMBERS ✈ ✈ ✈ ✈

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CABIN AIR QUALITY

Allen J. Parmet, MD, MPH-Medical Director, Trans World Airlines, Kansas City, MO.

The quality of air in commercial aircraft cabins has generated considerable public and employee concern over the past few years. Both the lay press and even medical providers are basing assessments on anecdotal observations. At my hospital's last staff meeting, I asked for a show of hands, starting by first asking what the atmospheric pressure was inside a commercial aircraft cabin. About 10% of the primary physicians on our staff thought that the aircraft was the same pressure inside as outside. Over half of them thought that the pressure inside the cabin was the same as at the ground level. Only about 40% realized that the pressure of the aircraft cabin is usually equivalent to 5-8,000 feet above sea level (1,525-2440 meters).

Many years ago the aircraft manufacturers accepted a cabin altitude limit of 8,000 feet as a compromise between weight performance and passenger comfort, because it represents the corner of the flat part of the hemoglobin-oxygen association curve for the average, healthy individual. Let me give you a description of the cabin of a commercial aircraft. This is essentially a metal balloon, which is pressurized by diverting part of the air stream from the intake of the jet engines. The intake part of a commercial jet engine is the compressor section. Air is drawn into the compressor and squeezed until it is dense enough to be mixed with fuel and then burned in the combustion section. Just before the air is injected into the combustion section, some of it is diverted and enters the aircraft environmental system. When the aircraft is at cruising altitudes of 30-40,000 feet, the outside air temperature is typically minus 40 degrees and has a pressure of between 150 and 100 mm of mercury. It is composed of 21% oxygen and differs primarily from the surface air, in that there is essentially no water or pollutants in it, although there may be elevated levels of ozone present, particularly during high latitude flights in winter. In the compressor, this air is pressurized to approximately 2,000 mm of mercury and its temperature is raised to 250 degrees centigrade. Some of the air is then bled off, expanded and cooled through a series of plumbing valves and distributed through the aircraft cabin. Through these steps, the pressure is reduced to the appropriate cabin altitude of 500-600 mm of mercury, but is still 21% oxygen. The heat decomposes most ozone, although a platinum catalyst can be placed in line for very high level exposures. The air is cooled to the appropriate temperature but it is not humidified and, therefore, humidity in the aircraft is extremely low and, in fact, is provided mostly by the exhaled breath of the passengers. Some passengers find this low humidity comfortable and others do not.

Interestingly, since the passengers' exhaled breath is actually the primary source of humidity in the cabin, recycled air actually has a higher relative humidity than does non-recycled air. In flights where we have done real-time monitoring of the cabin humidity, the humidity drops shortly after takeoff, down to the 5-10% range, but will climb as high as 20-25% during the cruise phase. When beverage service is begun, the humidity takes a large jump, as does the primary solvent contaminant of aircraft cabins, ethyl alcohol.

✈ ✈ ✈ *(continued on page 10)*

The first widely accepted surgical technique for doing this was Radial Keratotomy (RK). Initially, this was unacceptable to the FAA as an approved method for correction of myopia. Recently it has been approved by consult of an eye specialist being submitted (FAA Form 8500-7). There have been uncommon but serious complications. The most common are glare, fluctuation in vision during the day, and progression or regression of the refractive error for up to two years. Also reported complications include weakened corneal structure, recurrent epithelial erosion, and neovascular ingrowth along the corneal incisions. The current position of the FAA is to allow medical certification if the applicant meets the visual requirements, if an examination reveals healing is complete, if the vision is stable (usually by 6-12 weeks) and no significant glare exists.

As you, the Aviation Medical Examiner (AME) may surmise, the above criteria are difficult to define and delineate by the expert corneal surgeon and the FAA Form 8500-7 become an important consult for the FAA decision making following surgery.

RK is still commonly performed but it's successor, Photorefractive Keratectomy (PRK) is becoming very popular. This technique uses the excimer ("excited dimer" using Argon Fluoride gas) laser to actually sculpt the cornea into the desired shape, thereby changing its refractive power. The excimer laser reshapes the cornea by removing small amounts of corneal tissue through direct photochemical disruption of molecular bonds, in essence, sculpting the cornea to a flatter shape rather than relying on a weakened, flatter corneal structure, as in RK. PRK is used for about the same degree of myopia as RK; -1.00 to -7.00 diopters.

Some advantages to PRK include:

- Less chance for operator error.
- Elimination of significant radial scars that cause increased glare, or decreased vision (more physiologic than RK).
- Fewer enhancements. Often 1-2 enhancements (repeat cuts) are necessary in RK for complete (20/20) correction.

PRK is not without complications. Although uncommon, they include:

- Fluctuation in refraction with overcorrection and undercorrection.
- Corneal haze and possibly scarring, necessitating the long-term use of topical steroids.
- Glare (night vision with halos and starburst).
- Decreased contrast sensitivity.

Other problems include recurrent erosions, islands of irregularity with difficult refractive errors, decreased binocular visual acuity, and possible weakened corneal structure.

For higher degrees of myopia, Laser in-situ Keratomileusis (LASIK) is being used. This is technically more difficult than PRK and involves the use of keratome (the Lathe) to remove a thin, superficial layer of central cornea. The excimer laser is then used to ablate the central cornea as in PRK and the corneal flap is replaced, acting as a bandage contact lens. As promising as this technique has become for correcting myopia, it also has complications similar to PRK, i.e., induced astigmatism, glare, loss of best corrected visual acuity, and regression.

The most confusing part of the post surgical exam will occur for you, the AME, when you read in the new manual the requirements, i.e., visual, healing and other complications such as glare.

"The AME may issue the medical certificate following refractive surgery for Class I, II, and III."

Providing that consult FAA Form 8500-7 confirms:

1. Healing is complete.
2. Visual acuity is stable.
3. There is no significant glare intolerance.

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As with RK, the airman/airwoman must be observed for stability of vision for 6-12 weeks for complications and if any occur, an Eye Evaluation Form (FAA 8500-7) must be completed by an ophthalmologist. Since the risk of non-disclosure exists, topography and slit lamp examination screen all pilot applicants to the U.S. Air Force.

Remember, the purpose for pilots having refractive surgery is to achieve an uncorrected visual acuity of 20/20. While both RK and PRK can do this, only PRK accomplishes it without significant scarring and little evidence that the procedure has been done except through corneal topography. The majority of PRK and RK patients eventually achieve the goal of near uncorrected 20/20 vision. While this "majority" may be acceptable for the general population, it presents a real problem for the aeromedical community, if complications occur. The unique tasks performed in aviation and aerospace leave no room for compromise of good vision. Some patients who undergo refractive surgery will continue to require visual correction, i.e., glasses or contacts, to meet the rigid standards of 20/20 in each eye. Unfortunately, following RK and PRK, some are not able to meet the visual requirements, even with correction and the possible worst case scenario is the loss of binocular visual acuity. Also, remember that even though the surgical procedure is a success, the eye will continue to exhibit risks inherent with myopia, i.e., retinal tears or detachment and myopic degeneration, etc..

Military regulations disqualify for enlistment or commissioning any person who has had this surgery.

Even though the FAA is wavering this surgery for Class I certification, most airlines are not accepting for employment as pilots those airmen who have had the procedure.

Military attitude regarding pilots:

The military has no need for keratotomy patients as there are plenty of 20/20 individuals applying for flight training. The civilian airlines have adopted a similar attitude.

In defense of refractive surgery, the surgery is being done more selectively (better patient screening with more predictable and acceptable outcomes).

Both civilian airlines and the military are likely to take another look at potential flying candidates in the future.

Summary:
As Photorefractive Keratectomy becomes the procedure of choice for refractive surgery, newer generations of lasers promise to improve outcomes and reduce complications. Until these techniques are proven with time and research, refractive surgery is an option that should be undertaken with cautious optimism by the civilian pilot and avoided completely, at least for now, by anyone thinking of military aviation as a career.

INFLIGHT MEDICAL EMERGENCIES
Some Background and Tips for the Medical Practitioner
by Jerry Hordinsky, M.D.

If you find yourself in a scheduled air carrier at a time that a call for medical assistance comes over the speaker, what can you expect and what are your options?

Data on inflight medical events is not gathered uniformly across the air carriers. This past year, extensive newspaper footage in the Chicago Tribune (Reporter John Crewdson) attempted to back up the assertion that air travel in the U.S. is so safe that passengers are now more likely to die of illness inflight than in a crash. Later in the same year, American Airlines announced a plan to add automatic cardiac defibrillators by mid-1997, following a commitment made earlier by a limited number of foreign carriers (e.g., Qantas) in the early 90s.

This introductory review will intentionally not jump into the debate, but is instead focused on informing you of the basic inflight health situations that are encountered, and the resources at your disposal. The synopsis will focus on the typical U.S. air carrier environment.

✈ ✈ ✈ (continued on page 10)

Keep in mind that the U.S. air carrier fleet numbers about 4000 units and that approximately 500 million emplanements occur annually. A recent survey extrapolated to the entire domestic air carrier industry documented that 7500 significant inflight medical events occur annually. Not unexpectedly, neurological and cardiac etiologies were high on the list, leading also to the greatest total number of flight diversions for medical cause. However, obstetric-gynecological events, although less frequent, were associated with the highest diversion rate. Overall, approximately 8% of all inflight medical events resulted in diversions of the original flight. Flight crews generally (97%) of the time complied with medical advice to divert, and hospital admissions followed in 86% of the diversions. Keep also in mind that when we poll larger groups of visiting physicians (typically FAA aviation medical examiners) about their experiences in the delivery of inflight medical care, there seems to be an indication that more inflight events are occurring, but the inflight medical events and associated responses are just not systematically logged; this seems more likely for events perceived as minor and/or those quickly resolved.

If you do respond to an inflight emergency, your tools could include the "first-aid kit" which basically contains bandages, compresses, tapes and splints; depending on aircraft size, one to four such kits are onboard. You would have access to the standard (since 1986) medical kit which has a sphygmomanometer, stethoscope, and airways, as well as limited quantities of injectable epinephrine (1:1000), injectable diphenhydramine, and injectable 50% dextrose and nitroglycerin tablets. You could call for the portable oxygen system, which is limited to low flow rates. You could find yourself onboard an airline that maintains aeromedical/emergency physicians on call, and get supplemental advice through this type of resource. It seems so empirical, but if you urgently are wishing you had a particular medication, you frequently would find that many of the prevalent oral (and occasionally injectable) medications are carried as prescriptions by your fellow passengers.

Although the healthy debate about the adequacy of the above situation may be a future article theme, suffice it for now by saying there is no new current governmental regulatory initiative in this area. The operational changes (e.g., American Airlines adding automatic defibrillators) are driven by individual airline business decisions. Isolated novel clinical research (e.g., transmission of vital signs using direct tie-in to the "back-of-seat" phones and internet transmission) is driven by individual academic center initiatives.

A recent change in the newer commercial aircraft has dictated that some of the air that is pumped into the aircraft cabin is recirculated, rather than being continuously refreshed. Some 40 years ago, in the days of the Boeing 707 and DC-8, the air in the cabin was 100% exchanged about every 5-6 minutes. Some people have compared recycled aircraft cabin air to a sick building syndrome. This is not truly exactly the same condition, aircraft are not flying buildings. Environmental standards for aircraft and office buildings are derived from different sources. The primary source of contamination inside an aircraft is human beings, whereas contaminants inside an office building may represent the activities of cleaners, equipment and combustion products. The American Society of Heating, Refrigerating and Air Conditioning Engineers, who are otherwise known as ASHRE, realize that the standards for buildings are not appropriate for aircraft and, therefore, has formed a committee to support the development of air quality standards. In the meanwhile, the existing standards are designed for optimizing passenger comfort given the source of contamination. .

Recirculation of environmental air is the rule for office buildings, including hospitals because it means energy efficiency and cost savings. Air recirculation in new office buildings averages 1-2.5 fresh air exchanges per hour so ASHRE established a carbon dioxide level of 2,500 parts per million, a level indicative of stagnant air. Compare this to hospital operating rooms at 5 per hour and 10-15 in most aircraft. The amount of oxygen in the aircraft typically remains at 20-21% of the cabin air at all times. There is no significant alteration of the oxygen percentage within all altitudes operated by a commercial aircraft.

The reason for going to the recirculation of air is based upon fuel efficiency. As more and more air is

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diverted from the jet engine to provide cabin air, less and less goes through the engine itself to provide thrust for the aircraft. The result has been as much as a 42% fuel savings. This is an important factor, both economically and from the environmental pollution point of view. There has been considerable concern about the use of recycled air, but at the present time the alternatives are to greatly increase fuel flow and shorten the aircraft's range or reduce the passenger load by 20-50%.

Carbon dioxide levels in the cabin have traditionally been measured for the purpose of a surrogate for body odor, not to measure stagnant air, as in office buildings. Since the primary occupant of aircraft cabins is the passenger, and we have no effective technique for measuring body odor and relative aroma of the passengers, ASHRE adopted 1,500 parts per million of carbon dioxide as the surrogate limit. On a series of 20 flights, which we conducted in 1994 through 1996, this was exceeded only on two flights and both times, it was exceeded when beverage service was initiated. In all of these flights, when beverage service began, there was a spike in carbon dioxide levels and this reflects the opening of pressurized cans and bottles of carbonated beverages.

In newer aircraft such as the Boeing 767 or Airbus 320, there is approximately a 50% exchange of the cabin air every 4-5 minutes. The air enters at the top of the cabin and exits through vents on the floor. There is very little flow front to rear in the modern aircraft. As the air exits the cabin, approximately half of it escapes overboard and the other half is recirculated through a high efficiency particulate air filter (HEPA) to remove any biological contaminants. The HEPA filter is identical to those recommended for the prevention of tuberculosis and is highly efficient at removing any particulates above 10 microns in size or below 1 micron in size. In the range of 1-10 microns, they are capable of removing approximately 99.97% of the particulates. These are impact-type filters; that is, that the air flows through them, particles impact on the fibrous structure and deposit any particulate matter they are carrying.

This differentiates them from absorption filters where the air must flow through long channels, allowing gaseous materials to be absorbed to the surfaces of the filter. In impaction filters, that the more clogged they become, the more efficient they become at removing materials. So oddly, the older a filter is, the more efficient it is at removing material, although it does require more pressure to force the air through it. These filters are changed regularly when the pressure required to pump air through them becomes too high.

Additional studies for microbial aerosols and bacteria were conducted on the same series of flights. The number of bacteria and fungi was quite low, since the low humidity suppresses most bacteria. For example, Legionella pneumonia will not survive less than 90% humidity. Typically, we identified10-30 colonies per cubic meter compared to well over 1,000 colonies per cubic meter inside most airport terminals. If the aircraft is a smoking flight, the main particulate contaminant is environmental tobacco smoke. On a non-smoking flight, the most commonly identified particulate matter inside the aircraft cabin proved to be cat dander. Since we carry very few cats in the aircraft cabin, it is my suspicion that the source of this is probably passenger clothing.

Please read our next issue of the CAMA Bulletin for the continuation of Cabin Air.

Wanted

WANTED: dedicated CAMA members willing to make further contribution to our education, public relations, and legislative programs. Become a Sustaining Member by applying to the Board and paying $180.00 per year in dues. Your status and dedication as a Sustaining Member will be recognized in CAMA publications and respected by your peers. Our award plaque will proclaim to your friends and patients your participation and CAMA's gratitude.

News

MEETING SCHEDULES

45TH INTERNATIONAL CONGRESS OF AVIATION AND SPACE MEDICINE

OSLO, NORWAY

AUGUST 24-28, 1997

For more information, contact

Congress Secretariat, ICASM '97
Plus Convention Norway

P.O. Box 946, N-5001
Bergen, Norway

Phone (47) 55 30 30 76
FAX (47) 55 30 30 32

AEROSPACE MEDICAL ASSOCIATION 69TH ANNUAL SCIENTIFIC MEETING

Seattle, WA . . . .May 17-21, 1998

For more information on the AsMA meeting, contact:

RUSSELL RAYMAN, M.D.
AsMA
320 S. HENRY STREET
ALEXANDER, VA 22314
(703) 739-2240

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August 29-30, 1997
Sydney, Australia - Fifth Annual Scientific Meeting of Diving and Hyperbaric Medicine. Contact: Conference Coordinator, Dept. of Diving and Hyperbaric Medicine, Prince of Wales Hospital, High Street, Randwick, NSW, 2036, Australia; Phone: (02) 93823881; Fax: (02) 93823882

September 29-October 3, 1997
Rotterdam, The Netherlands
AGARD Aeromedical Support Issues in Contgency Operations. Info: AGARD, 7 rue Ancelle, 92200 Neuilly-sur-Seine, FRance; Phone: 33 (1) 74 38 57 60/62; Fax: 33 (1) 47 38 57 99

October 5-9, 1997
Cincinnati, OH - Air Medical Transport Conference (AMTC). Contact: Melinda Adams, Association of Air Medical Services, 35 S. Raymond Ave., Suite 205, Pasadena, CA 91105; Phone: (818) 739-1232; Fax 818-793-1039

FAA AVIATION MEDICAL EXAMINERS (AME) SEMINAR SCHEDULE

Okla. City, OK . . . . .Aug. 18-22, 1997
Atlanta, GA . . . . .Nov. 7-9, 1997
Okla. City, OK . . . . .Dec. 8-12, 1997

For more information, contact your Regional Flight Surgeon or:
Mr. Douglas R. Burnett
AAM-400
Aeromedical
Education Division
P.O. Box 25082
Oklahoma City, OK 73125
(405) 954-4830/6214

ANNUAL CAMA MEETING DATES

New Orleans, LA . . . . .Sept. 3-6, 1997
Hilton Riverside Hotel

Los Angeles, CA . . . . .Sept. 2-6, 1998
Hilton Airport Hotel

October 23-25, 1997 Orlando, FL
Civil Aviation Medical Association
Aircraft Owners & Pilots
Association Expo 1997. Contact
CAMA Headquarters.

CAMA will publish specific information when details are available.

CAMA Headquarters

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